Energy Use in Irrigation Water Management

One of the primary reasons to utilize irrigation water management (IWM) is the proper use of water; i.e. - conservation. The primary use of energy in irrigation is for pumping water. By logical extension, IWM is critical in the conservation of energy.

Energy sources for irrigation are primarily derived directly from fossil fuels, such as natural gas and diesel, and from electricity, which is generated from a variety of sources. Some water sources provide sufficient energy for irrigation due to the elevation difference between the source and the field.

When discussing alternative energy sources for irrigation, a primary focus is on solar energy producing electricity from photovoltaic cells. The current initial cost of these systems, which is about $10,000 per kilowatt (equals about $7,500 per horsepower), preclude their use for production irrigated agriculture.

The greatest return on investment for energy could easily be the proper operation and maintenance of the irrigation system.

Power = (Flow rate x Pressure)/Efficiency

Energy Use Example #1 – A farmer has a well-maintained electrically powered pumping plant that has an overall efficiency of 60%. Electricity cost $0.10 per kilowatt hour. The required total pressure is 100 psi and 30 inches of water are applied during the season on a 100 acre field. IWM determines that 25 inches could be applied and still provide for the crop needs (A savings of 5 inches). How much money for energy can be saved by applying IWM?

Result: (5 inches x 100 acres x (3,630 cf / ac-in) x (62.4 # / cf) x (100 psi) x (2.31 ft / psi) x (1 HP/ 33,000 ft # / min) x (0.746 kwh / HP-hr) x (1hr / 60 min) x ($0.10 / kwh))/(Eff = 0.60)) = $1,642.84 saved by reducing the water applied from 30 inches to 25 inches.

Energy Use Example #1A – How much more money could be saved in the above example, if the overall pumping plant efficiency could be increased from 60% to 70%?

Result: ($1,642.84) x ((70/60) - 1) = an additional $273.80 saved by increasing pumping plant efficiency from 60% to 70%.

Movement takes energy